

Understanding Oil Spill Dispersants: Efficacy and Effects

A report of the National Academies

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Dispersant Use in the U.S.

- Regional Response Teams (RRTs) have established “pre-approval” zones in most offshore areas
- Dispersants have been used 8x in the U.S., 7x in the Gulf of Mexico since 1999
- Proposed USCG rules will require ability to apply dispersants within 12 hours in all pre-approval zones
- Availability of dispersant application resources will likely lead to consideration of dispersants in nearshore areas
- RRTs have been conducting Ecological Risk Assessment Workshops to discuss dispersant use in nearshore areas

Sponsors

- Minerals Management Service, DOI
- National Oceanic and Atmospheric Administration
- American Petroleum Institute
- U.S. Coast Guard

STATEMENT OF TASK

1. Review and evaluate **ongoing research and existing literature** on dispersant use (including international studies) with emphasis on:
 - a) factors controlling dispersant effectiveness (e.g., environmental conditions, dispersant application vehicles and strategies, and oil properties, particularly as the oil weathers),
 - b) the short- and long-term fate of chemically or naturally dispersed oil, and
 - c) the toxicological effects of chemically and naturally dispersed oil

STATEMENT OF TASK (cont.)

2. Evaluate the adequacy of the existing information about dispersants to **support risk-based decisionmaking** regarding response options for a variety of spatially and temporally defined oil spills
3. Recommend steps that should be taken to **fill existing knowledge gaps**. Emphasis will be placed on how laboratory and mesoscale experiments could inform potential controlled field trials and what experimental methods are most appropriate for such tests

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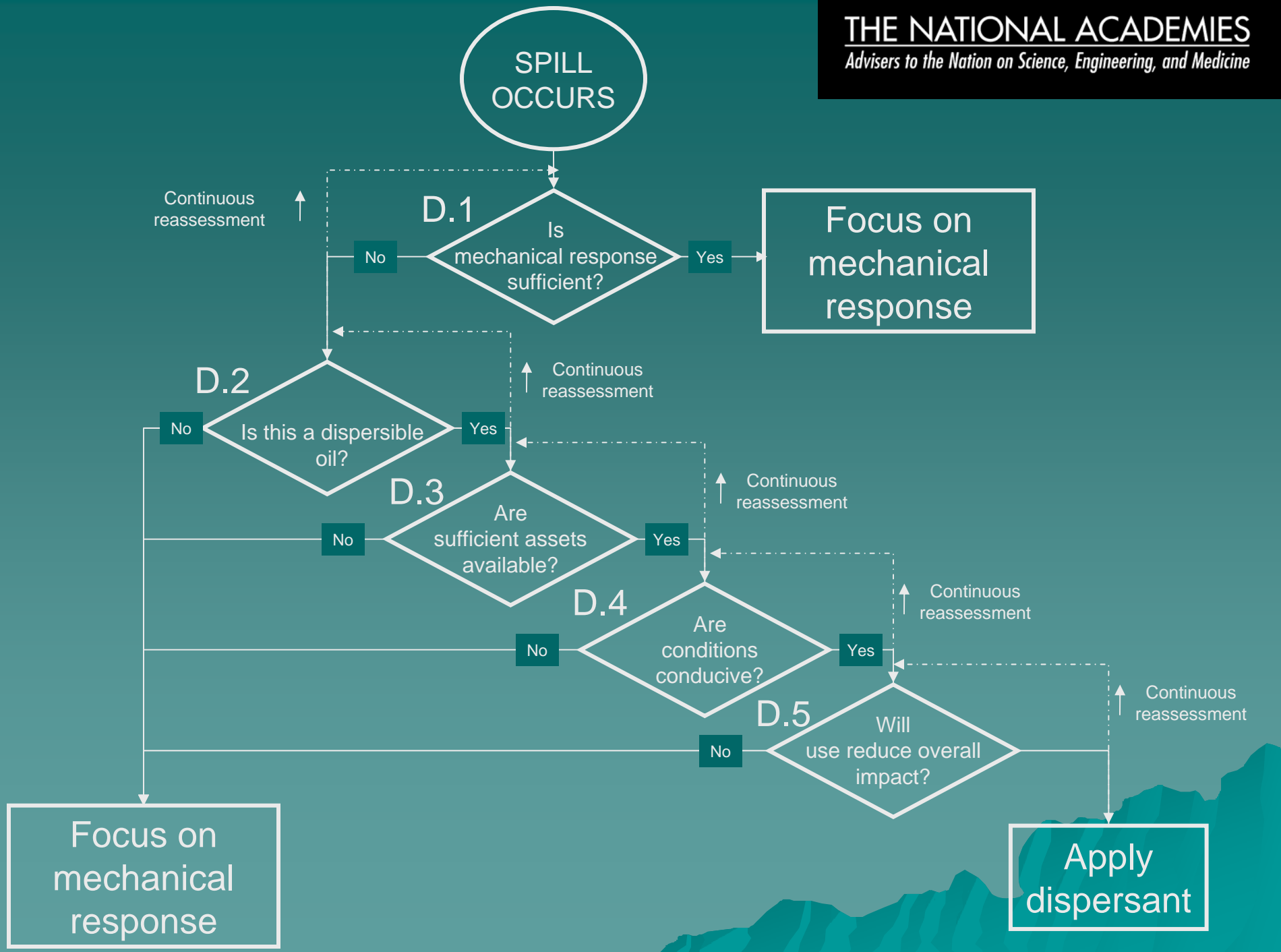
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Primary Finding

In general, the information base used by decisionmakers dealing with spills in areas where the consequences of dispersant use are fairly straightforward (e.g., situations where rapid dilution has the potential to reduce the possible risk to sensitive populations or habitat) **has been adequate.**

Thus,

Primary focus of this report is on supporting decisions involving trade offs among sensitive species or habitats in **nearshore settings.**

Report Recommendations

NOAA, the Environmental Protection Agency (EPA), the Department of the Interior (including MMS and USGS), USCG, relevant state agencies, industry, and appropriate international partners should work together to **establish an integrated research plan**, which focuses on collecting and disseminating peer-reviewed information about key aspects of dispersant use in a scientifically robust, but environmentally meaningful context.

Recommendations are directed to “the community”

- researchers and modelers (investigators)
- program managers (funders)
- agency and corporate leaders (budget managers)

Report Recommendations

. . . develop and implement a focused series of studies that will enable the technical support staff advising decisionmakers to **better predict the effectiveness of dispersants for different oil types and environmental conditions** based on climatological data supplemented with real-time in-situ observations.

- Objective is to determine relationship between energy dissipation rates and chemical effectiveness for different oils and weathering state
- Measure key parameters (e.g., energy input, droplet-size distributions)
- Effectiveness on weathered emulsions is important
- Accepted standards of experimental design

Report Recommendations

. . . **determine the mechanisms** of both acute and sublethal toxicity to key organisms from exposure to dispersed oil. With a better understanding of the mechanisms of toxicity, then toxicity tests can be refined to generate data on toxic levels and thresholds for use by decisionmakers.

. . . **quantify the weathering rates and final fate** of chemically dispersed oil droplets compared with undispersed oil.

Report Recommendations

... develop and implement a focused toxicity studies to:

- ◆ Predict photo-enhanced toxicity;
 - For light sensitive organisms, studies have shown increased oil toxicity
 - Could significantly increase the “footprint” of impact area
- ◆ Estimate the relative contribution of dissolved and particulate oil phases to toxicity; and
- ◆ Expand toxicity tests to include an evaluation of delayed effects

Report Recommendations

Studies should be undertaken to assess the ability of **fur and feathers to maintain the water-repellency** critical for thermal insulation under dispersed oil exposure conditions comparable to those expected in the field.

- ◆ Was a recommendation of the NRC (1989)
- ◆ Has not been adequately
- ◆ Important assumption in the environmental trade-off analysis

Report Recommendations

. . . develop and implement detailed plans (including preposition of sufficient equipment and human resources) for **rapid deployment of a well-designed monitoring effort** for actual dispersant applications in the United States.

. . . initiate a detailed investigation using **wave tank** studies that specifically address the chemical treatment of **weathered oil emulsions**.

. . . initiate a detailed investigation of upper sea-surface turbulence with particular emphasis on quantifying horizontal and vertical diffusivities and the **rate of energy dissipation**.

Report Recommendations

Future field-scale work, if deemed necessary, **should be based on the systematic and coordinated bench-scale and wave tank testing** recommended in the report.

Field studies benefits:

- best representation of reality
- Best for operational effectiveness
- Only way to measure of hydrodynamic effectiveness
- Can test relationships that affect dispersant effectiveness
- Useful for model calibration.

Report Recommendations

Field studies weaknesses:

- expensive so have limited scope and duration, no replication
- limited data set from any one trial, reflects only test conditions
- cannot control weather, physical conditions
- field measurements are more difficult
- operational effectiveness may be higher than “real” spills

Difficult to envision the proper role of field testing where researchers have yet to reach consensus on standard protocols for wave tank tests

HOW DO WE MAKE ALL THIS HAPPEN?

NOAA, EPA, DOI, USCG, relevant state agencies, industry, and appropriate international partners should work together to establish an integrated research plan, which focuses on collecting and disseminating peer-reviewed information about key aspects of dispersant use in a scientifically robust, but environmentally meaningful context.

First steps towards this recommendation happening next week. Coastal Resource and Research Center of the University of New Hampshire is sponsoring a forum to discuss and coordinate dispersant research needs.

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www.nationalacademies.org/osb

www.nap.edu/catalog/11283.html